

# Miniature High Force, Long Stroke Linear Shape Memory Alloy Actuators, Phase II

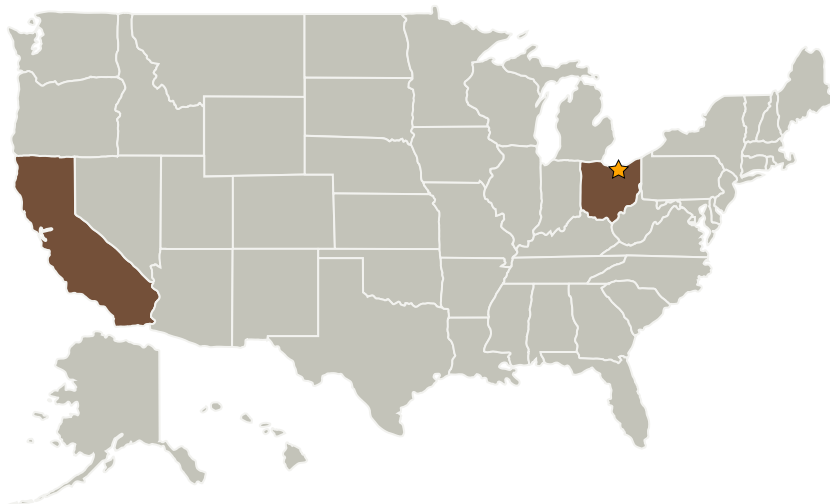
Completed Technology Project (2007 - 2009)



## Project Introduction

Shape Memory Alloys (SMAs) are metal alloys (of Nickel-Titanium, for example) that can change their shape when heated. When drawn and processed in wire form, the shape change is an aggressive contraction, with useable lifetimes of millions of cycles. Despite this fact, SMAs have largely been a scientific curiosity, finding very little commercial use as actuators since their discovery over 30 years ago. The apparent lack of practical application may be attributable to their low recoverable strain (~4% of total wire length). MIGA Motor Company has numerous international patents covering Displacement Multiplication (DM) techniques that allow us to package large strokes in highly compact, lightweight packages. Our current commercially available electric linear actuators provide 1/2" of stroke with 4.5 pounds of output force. We propose to develop several high force variants of our DM designs, allowing up to 32 lbf (high cycle count) or 48 lbf (hundreds of cycles) in a device weighing less than 2 ounces. The manufacturing techniques that we have developed in manufacturing the DM actuators have paved the way to expansion into the high force realm: high reliability wire attachment methods, use of high temperature thermoplastics, protected or over-molded precision chemically-etched stainless-steel stages, and various load-sharing techniques have enabled these powerful actuators to finally become a reality.

## Primary U.S. Work Locations and Key Partners



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Glenn Research Center (GRC)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
MIGA Motor Company	Supporting Organization	Industry	Saint Helena, California

Primary U.S. Work Locations	
California	Ohio

## Project Transitions

**November 2007:** Project Start**November 2009:** Closed out

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

## Technology Areas

**Primary:**

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - └ TX12.1 Materials
    - └ TX12.1.8 Smart Materials